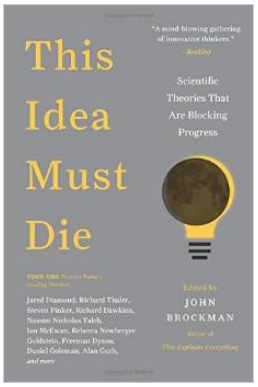
This Idea Must Die: Scientific theories that are blocking progress *John Brockman* (ed.). Harper Perennial, 2015, ISBN 978-0062374349 (pbk), 592 pp.

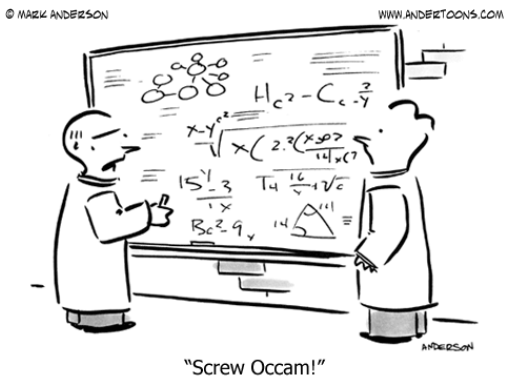


John Brockman

John Brockman is a science author and founder of the *Edge Foundation*[1]. This organization tries to bring together a broad selection of scientists who work at the edge of their domain. In particular those belonging to the 'third culture'. That are those that try to bring together again the 'sciences' and the 'humanities' which P.C. Snow defined in 1959 as the two diverging cultures in Western civilization. So also non-science authors are included in this project.

Every year since 2005 Brockman proposes a broad science question and collects the vision of a large number of authors that are published as a book. Some examples of previous questions: *What do you believe is true even though you cannot prove it?* (2005), *How is the internet changing the way you think?* (2010), *What should we be worried about?* (2011), and in 2014 *What scientific idea is ready for retirement?*. The harvest of answers to the latter are collected in this book.

The book contains more than 150 short answers with their argumentation. The collection is very broad, from cosmology, to brain science to psychology, to computer science, to biology and sociology, or whatever field you might think of, and you probably have your own answer that is not even there. If you look at the ideas that are ready to get rid of, then it is as if almost anything is ready for the waste bin. The arguments are somewhat more subtle and they might even raise the feeling 'Well if you look at it this way, then perhaps...'.



Max Planck once claimed that progress is only possible one funeral at a time. New ideas get only accepted by a new generation, when representatives of the old vision literally die. Even this idea is one that should die according to some of the contributors. Once good arguments are given, then new ideas get quickly accepted. And we should also drop the principle of Occam's razor. The simplest possible explanation is not always the proper one. It may help to accept a heliocentric theory over a geocentric one, but reality is not always simple. The parabolic trajectory of a thrown object is simple and beautiful, but a falling leaf is subject to much more complicated physics. Hence drop simplicity. Some ideas come up repeatedly like the theory of everything and the grand unification theory. The Big Bang theory should be abandoned. There is not just one universe, and it did not start with lowest possible entropy, anyway the importance of the second law of thermodynamics and the prominent role of spacetime in general relativity theory should be relaxed as well.

I will not go though all of the contributions, but select some that might be of interest to mathematicians.

Allocating funds via peer review: This is just a waste of time. Long term research is unpredictable anyway. Just give money to postdocs who do not need to submit a project and evaluate after a period based on publications and citations resulting from their research.

Infinity. Max Tegmark[2] proposes to drop the notion of infinity. Everything is essentially discrete

[1] edge.org

[2] Max Tegmark, *Our mathematical universe*, reviewed in this newsletter, issue 98, May 2014.

which removes the necessity to talk about the infinitely large and the infinitely small, thus we should also drop the notion of continuity.

Cause and effect: We like to think one-way where some phenomenon is the cause and another is the effect, but when the output influences the input, it is not clear what is cause and what is effect.

Things are either true or false: What is true and what is not depends on the framework. What is true today may not be true tomorrow.

Multiple regression as a means of discovering causality: A correlation between the use of olive oil and mortality, does not imply that you will live longer by consuming olive oil.

The uncertainty principle: Heisenberg used *Unschärferelation* which is wrongly translated as uncertainty relation.

Big data: This is the hype of the moment. Science is not big data, and not all the effort and all the funding should go to big data projects.

Science is self-correcting: Some ideas are misunderstood or wrongly translated and become urban legends. And these are very hard to be removed, even though there is often ample evidence against them.

The way we produce and advance science: Sometimes the cost for a scientific result (e.g. the search for the Higgs boson) is beyond proportion, and in domains where there is a hard competition, researchers may be forced to slavery, working day and night to get some result ready in time.

Geometry: We can still use geometry, but geometry is no longer the description of physical space. Quantum geometry is not much of geometry any more.

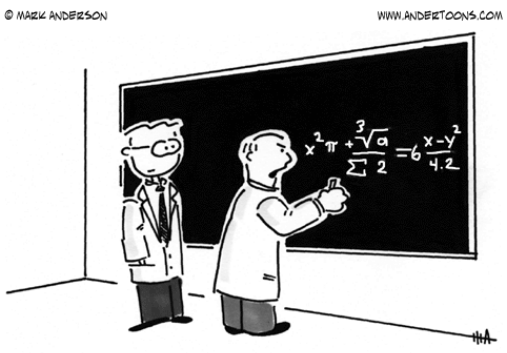
Calculus: The role of calculus in our education system should be reduced to make place for discrete mathematics, and undergraduate computer science.

Computer science: This has evolved into an abstract digital world, totally disconnected from the physical machines on which the software should run. Time to introduce physical units into computer science.

Statistical significance: Medical or physical papers get published to prove something by experiments that are 'statistically significant', i.e., random effects are excluded with high probability. However, in most cases it is not the random effect, but some careless set-up of the experiment or some misinterpretation of the researcher, or just some plain error that gives a wrong result that passes the statistical significance test perfectly. The same abuse of statistics happens in social sciences that embrace more and more the numerical approach.

Average: The averages of a property taken over groups are used to compare the groups, but the variance may be much more important.

Standard deviation: This notion should be left to mathematicians and physicists, and should be replaced by mean deviation, i.e., not summing the squares of the deviation from average (root mean square), but sum the absolute values (ℓ_1 instead of ℓ_2), which is much more relevant.



"It doesn't have to be politically correct!"

Statistical independence: The whole world is interconnected by gravity alone, yet most statistical analysis relies on independent variables.

Let me emphasize that this selection is not made because they represent my own vision. It is only a small selection in which I tried to formulate a brief approximation. For more details you should read the book.

The penultimate contribution in the book is by R.S. Wurman, the founder of the TED conference:

Certainty, absolute truth, exactitude: None of these can be absolute and they only block the launching of new ideas.

A. Bultheel